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EXAMINER				
CORRIELUS, JEAN B				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/080,933

**Applicant(s)**

ZHANG ET AL.

**Examiner**

Jean B. Corielus

**Art Unit**

2611

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 December 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 21, 23-28, 30-33, 36-38, 40-42, 46 and 47 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 21, 23-28, 30-33, 36-38, and 40-42, 46-47 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 August 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Drawings*

1. The drawings are objected to under 37 CFR 1.83(a) because they fail to show a signal input to the "joint optimizer", shown in fig. 3 (as described in the specification page 8, lines 15-16, fig. 3 is a block diagram of a portion of the receiving station that forms part of the system shown in fig. 1. Since fig. 3 is a block diagram of a receiving portion of fig. 1, it is not clear how the optimizer 74 shown in fig. 3 is to be connected to existing component(s) of fig. 1 to receive its input). **Shouldn't the specification page 8, lines 15-16, be amended to recite "Figure 3 illustrates the functional block diagram of the joint optimizer, prefilter and decision feedback sequence estimator shown in fig. 3"? Such amendment would overcome the drawing objection.** Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each

drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

2. The drawings were received on 12/30/09. These drawings are **not acceptable** because there is no support in the specification as filed for the drawings as now presented. With respect to fig. 1, the description of fig. 1, as filed does not support the inclusion of a circuit block of "prefilter and feedback filter coefficients calculator". With respect to fig. 2, signal **"53"**, input to "joint optimizer 74" is not supported by the original disclosure and therefore **should be deleted**. The **output of prefilter 56 should feed the DFSE 58. DFSE 58 should include an output line.** With respect to fig. 3, **remove the input 53 to "joint optimizer 74"**, as the optimizer is described to only receive "estimates".

3. Examiner also notes that the amendment is not in accordance with 37 CFR 1.121(d) that states that **any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended**. In the immediate prior version of the drawing sheets, both figs. 2 and 3 were presented in separate sheets. Accordingly, the replacement sheets have to be presented separately as well.

**Examiner's comment**

4. Note that claims 38, 40-42 recite means plus function limitations and effectively invoke 112 sixth paragraph. The claims are treated as such.

***Claim Objections***

5. Claims 26, 28 and 36 are objected to because of the following informalities: claim 26, "signal filter" should be replaced by "prefilter", to be consistent with claim 21, that recites that the "prefilter configured to receive the optimized values", the signal filter does not receive the optimized values.

As per claim 28 some of the limitations recited in the claim are redundant and therefore should be amended as follow to remove the previously recites claim limitations :28 . " The apparatus of claim 25, wherein the optimized values received from the signal optimizer are used to define filter characteristics of the feedback filter".

With respect to claim 36, lines 2-3, does the limitation "the forming" refer to "the forming optimized feedforward filter parameters" and/or "the forming optimized feedback filter parameters" please correct. Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 21, 23-26, 28, 30-33, 36, 38, 40-42 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zangi et al US Patent No. 6,775,322 et al. in view of Ketchum et al US Patent No. 6,760,388.

As per claim 21, Zangi et al teaches a receiving station (figs. 1 and 3) comprising a signal filter see col. 3, lines 47-50 inherently in communication with a signal receiving antenna (note fig. 1 is described by Zangi as see col. 3, lines 29-30, as a mobile station therefore it has to include an antenna); a signal estimator 122 in communication with the signal filter see col. 4, lines 57-60; circuit (124) corresponding to the claimed (signal optimizer) configured to generate tap coefficients (optimized values) for the signal from the signal filter ; a prefilter 102 configured to filter the signal from the signal filter using the generated tap coefficients (optimized values) for the signal see col. 4, lines 59-61; circuits (104, 106 and 108) considered as the claimed "decision feedback sequence estimator" to receive the coefficients (optimized values) note input to filter 104, circuit blocks (104, 106 and 108) "decision feedback sequence estimator" comprising a summing element 106, a feedback filter 104 and a maximum likelihood sequence estimator 108, see col. 11, lines 9-12, as shown in fig. 3, Zangi teaches that the summing element 106, the feedback filter 104 and the MLSE 108 are operatively connected to one another and further connected to prefilter 102. Note that the interconnection of the prefilter 102r, the feedback filter 104, the MLSE 108 and the summing element 106 cooperatively operate to permit inherently concurrent interference and prefilter operation to be performed because there is no structural difference between the Zangi's disclosed features of prefilter, the feedback filter, the

MLSE and the summing element and the applicant claimed features of "prefilter, the feedback filter, the MLSE and the summing element". However, Zangi et al does not explicitly teach that the apparatus is a MIMO system having a plurality of signal receivers where concurrent interference and prefilter operation can be performed for a plurality of signals received through said signal receivers. Ketchum et al teaches a MIMO system Fig. 1 having a plurality of signal receivers 154a, 154r Note fig. 1 where concurrent interference and prefilter operation can be performed for a plurality of signals received through said signal receivers using MIMO processor 160 (Note fig. 3 and 5A, for instance). Given that fact, it would have been obvious to one skill in the art to incorporate such a teaching in Zangi in order to improve signal detection since the system would have been able to be configured to receive multiple copies so that existence of signal error can be easily determined.

As per claim 23, Zangi et al teaches that the output of the decision device (MLSE) 108 is configured to transmit generated maximum likelihood values through an output to the feedback filter 104 and the input of the decision device (MLSE) 108 is configured to receive summed values from the summing element 106.

As per claim 24, Zangi et al teaches the feedback filter 104 comprises a first input in communication with circuit 124 (signal optimizer) and configure to receive the optimized values from the circuit 124 (signal optimizer ) and a second input configured to receive the generated maximum likelihood values from the MLSE 108.

As per claim 25, Zangi et al further teaches the summing element 106 receives inputs from prefilter 102 and the feedback filter 104 and sends a summed output to the MLSE device 108.

As per claim 26, the signal filter see col. 3, lines 47-50 is located in the forward path of the receiving station hence it has to be a feedforward filter.

As per claim 28, Zangi further teaches that the feedback filter 104 receives optimized signals from the signal optimizer 124 that are used to define filter characteristics of the feedback filter 104 see col. 4, lines 57-60.

As per claim 30, the signal filter see col. 3, lines 47-50 and the signal estimator 122 is placed in the received chain of the receiving station see fig. 1.

As per claim 31, Zangi et al does not teach the further limitations recited in claim 31. Ketchum et al teaches the further limitations of a plurality of receive chains corresponding to the plurality of signal receivers configured to receive and transmit a plurality of data vectors to the plurality of receive chains note fig. 1. Given that fact, it would have been obvious to one skill in the art to incorporate such a teaching in Zangi et al and the motivation to do so would have been the same as provided with respect to claim 21 above.

As per claim 32, see claim 31. In addition, Zangi teaches transmitting the coefficients (optimized feed forward filter parameters and the optimized feedback filter parameters) to a decision feedback sequence estimator (104, 106 and 108), wherein the decision feedback sequence estimator (104, 106 and 108) comprises a feedback filter 104: note that the limitation "simultaneously" is interpreted as "both". Clearly Zangi



teaches that "both" interference cancellation and prefiltering operations are performed via the feedforward filter 102 and the feedback filter 104. See col. 4, lines 43-50. In addition, for the sake of argument, note that the prefiltered signal from feedforward filter 102 is provided as input to the summer 106 at the same time as the ISI compensated signal generated by feedback filter 104 (see col. 7, lines 15-21) another indication that the prefilter and ISI compensation are performed simultaneously.

As per claim 33, Zangi et al further teaches the feedforward filter 102 filters the data vector and transmitting a feedforward output to a summing element 106; receiving an output of the summing element in a MLSE device 108 and generating an output of that is transmitted to an input of the feedback filter 104 and subsequent component and filtering the output received from the MSLE device in the feedback filter 104 and transmitting a filtered signal to the summing element 106.

As per claim 36, Zangi further teaches the received chain comprises a receiving filter see col. 3, lines 47-50 inherently in communication with a signal receiving antenna (note fig. 1 is described by Zangi as see col. 3, lines 29-30, as a mobile station therefore it has to include an antenna); a channel estimator 122 in communication with the receiving filter; the channel estimator 122 in communication with circuit 124 corresponding to the claimed signal optimizer configured to optimized feedforward and feedback filter parameters see col. 5, lines 1-27.

As per claim 38 see rejection of claim 21 above in addition, Zangi et al teaches a receiving station (fig. 1 and 3) comprising receive filter (signal filter means) for filtering a signal from a receiver note col. 3, lines 47-50; a signal estimator means 122 for

estimating channel operations of the signal from the signal filtering means; means 124 corresponding to the claimed signal optimizing means in communication with the signal filtering means for generating coefficients (optimized values); prefiltering means 102 for filtering the signal from the signal filtering means using the generated coefficients (optimized values) means (104, 106 and 108) considered as the claimed "interference cancellation means" for receiving the coefficients (optimized values ) to perform concurrent interference and prefilter operations; Zangi further teaches that means (104, 106 and 108) (interference canceling means) comprises summing means 106 for summing inputs from the prefiltering means 102; MLSE means 108 for generating maximum values from the summing means 106; and feedback filtering means 104 for filtering an output of the MLSE 104 based on the generated optimized values to generate feedback-filtered values. Note that the interconnection of the prefiltering means 102, the feedback filtering means 104, the MLSE means 108 and the summing means 106 cooperatively operate to permit inherently concurrent interference and prefilter operation to be performed because there is no structural difference between the Zangi's claimed features of prefiltering means, the feedback filtering means, the MLSE means and the summing means and the applicant claimed features of "prefiltering means , the feedback filtering means, the MLSE means and the summing means.

As per claim 40 see claim 23.

As per claim 41 see claim 24.

As per claim 42, Zangi et al further teaches the summing element 106 receives inputs from prefilter 102 and the feedback filter 104 and sends a summed output to the

MLSE device 108 and an output of the MLSE being an output from the receiving station see fig. 3.

As per claim 46, Zangi teaches that the apparatus is a mobile communication device. See col. 3, lines 29-30.

As per claim 47 the device is inherently an integrated circuit because mobile communication devices uses IC circuit.

8. Claims 27 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zangi et al US patent No. 6,775,322 in view of in view of Ketchum et al US Patent No. 6,760,388 and further in view of Taylor US Patent Application No. 2002/0197987.

As per claim 27, Zangi et al and Ketchum et al teach every feature of the claimed invention but do not explicitly teach the further limitation of a deinterleaver in communication with an output of the MLSE estimator and depuncture in communication with a deinterleaver and a channel decoder in communication with the deinterleaver. Taylor et al teaches a deinterleaver 58 in communication with an output of the MLSE estimator (i.e. output of demodulator/equalizer 56) and depuncture 62 in communication with a deinterleaver 58 and a channel decoder 64 in communication with the deinterleaver 58. It would have been obvious to one skill in the art to incorporate such a teaching in Zangi et al and Ketchum in order to recover the originally transmitted signal.

As per claim 37, see claim 27.

#### **Examiner's Suggestions and Comment**

9. The application includes allowable subject matter, not properly claim. If allowable subject matters are properly claimed, such claims may be given favorable consideration. The combination of fig. 2 and fig. 3, for instance, includes the allowable subject matter that can be incorporated into the claims, such as claim 21, as follow, for favorable consideration:

21. An apparatus, comprising:

a first signal filter configured to filter a signal from a first signal receiver of a multiple- input, multiple-output system;

a first signal estimator configured to estimate channel operations of the signal from the first signal filter;

a second signal filter configured to filter a signal from a second signal receiver of the multiple- input, multiple-output system;

a second signal estimator configured to estimate channel operations of the signal from the second signal filter;

a joint signal optimizer configured to receive the channel estimates from the first signal estimator and the second signal estimator and to generate optimized values for the signals from the first signal filter and the second filter;

a prefilter configured to filter the signals from the first signal filter and the second signal filter using the generated optimized values for the signals; and

a decision feedback sequence estimator configured to receive the generated optimized values and the output of the prefilter,

wherein the decision feedback sequence estimator comprises a summing element, a feedback filter, and a maximum likelihood sequence estimator, wherein the summing element, the feedback filter, and the maximum likelihood sequence estimator are operatively connected to one another and further operatively connected to the prefilter,

wherein an interconnection of the prefilter, the feedback filter, the maximum likelihood sequence estimator, and the summing element in the apparatus is configured to permit concurrent interference and prefilter operations to be performed for [a plurality of] the signals received **from the first signal filter and the second signal filter [by a plurality of signal receivers in the multiple-input, multiple-output system].**

10. **Note that the claim amendment as proposed above may include informalities and therefore should be reviewed carefully to determine and correct any such informalities.**

#### ***Response to Arguments***

11. Applicant's arguments filed 12/30/09 have been fully considered but they are not persuasive. Note examiner's comments with respect to the drawing that address much of applicant's comment regarding the same. In addition, Applicant argues that the number of inputs to the optimizer 74 is 2x the number of receive antenna 22. However, it is noted that the number of inputs should be the same as the number of received antennas, note the specification, page 12, lines 10-14. applicant's argument with

respect to Zangi et al, Malkemes and Taylor not disclosing a MIMO system are moot in view of the above new ground of rejection(s). Applicant arguments at pages 17-19 regarding Zangi have been previously addressed, at least in the last office action, and therefore will not be readdressed.

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jean B. Corrielus whose telephone number is 571-272-3020. The examiner can normally be reached on Monday-Thursday from 9:30-3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh Fan can be reached on 571-272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jean B Corrielus/  
Primary Examiner, Art Unit 2611